REMARKS

Claim objections

Amendments have been made to address formal issues raised by the Examiner with respect to claims 7 & 8. Applicants respectfully submit that these changes are purely pedantic in nature and do not affect any of: the scope of the claims, their definiteness, or whether they are enabling. Accordingly, no filewrapper estoppel should result.

New claim

Applicants have added new claim 16, herein. Entry will be proper after the Examiner withdraws the final action in view of the errors discussed in more detail below.

Art rejections

The art rejections are respectfully traversed.

Any of the Examiner's rejections and/or points of argument that are not addressed below would appear to be moot in view of the following. Nevertheless, Applicants reserve the right to respond to those rejections and arguments and to advance additional arguments at a later date. No arguments are waived and none of the Examiner's statements are conceded.

The prior comments are incorporated by reference and supplemented as follows:

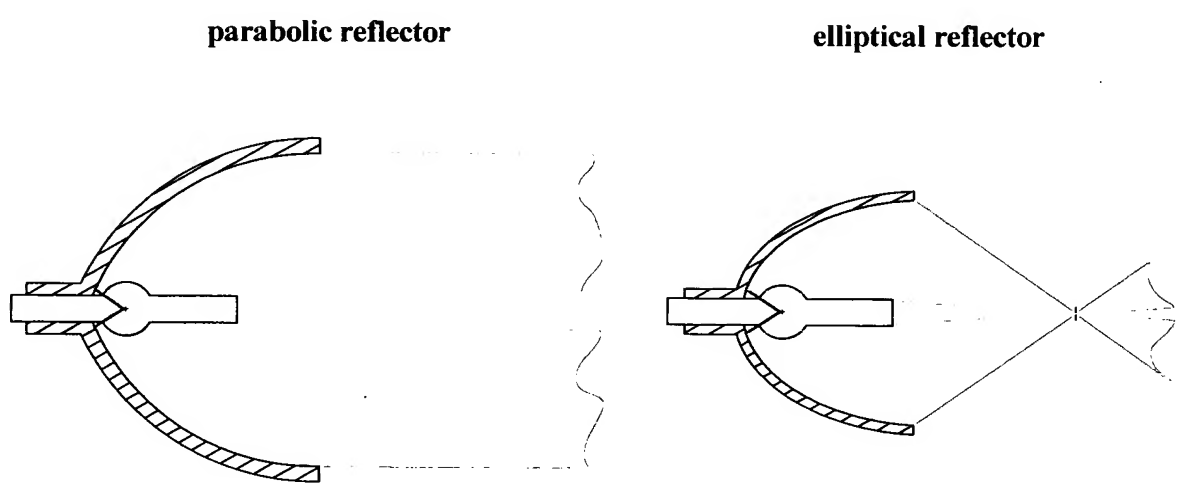
REMARKS

CLAIM 1

In claim 1, Applicants claim a discharge lamp with a reflector. The lamp is cooled by a nozzle that does not substantially extend into the beam path of the lamp. The Examiner states that the lamp disclosed by Sakugi shows such a nozzle.

Applicants respectfully disagree. The beam path in a discharge lamp is given by the emission pattern from the lamp and the reflection pattern from the reflector. For the two most common reflector types, namely parabolic and elliptical reflectors, the beam path is shown in the following figure.

FIG. A



The discharge-vessel and reflector dimensions used in Fig. A are taken from typical UHP-lamps. The yellow area shows the beam paths for the two reflector types. As can be seen, the beam path extends very close to the neck-region of the reflector where the discharge vessel is

mounted to the reflector. In this reflector-region, all the light emitted by the discharge into the backwards-direction is reflected towards the opening of the reflector.

Fig. B below shows Fig. 1 from Sakugi, yellow-shaded cones have been added to illustrate the light path. The red lines show the limits of the light-emission pattern from the discharge vessel 1 (limited due to the shape of the discharge vessel). As can be seen, light that is emitted in the backwards direction and towards the top of the discharge vessel will partially be blocked by the nozzle 5. The blocked beam path is indicated by the orange-shaded area. Even in the original disclosure of Sakugi, the light loss would be substantial. Since no accurate dimensions are given in the patent of Sakugi, no quantitative assessment of the effect can be given for this situation. However, Sakugi's patent would be immediately understood by those of ordinary skill in the art as applying to metal-halide lamps with only limited luminance from the pre-UHP era. Modern UHP-lamps deliver much higher luminance and flux values and usually are much more compact than typical metal-halide lamps.

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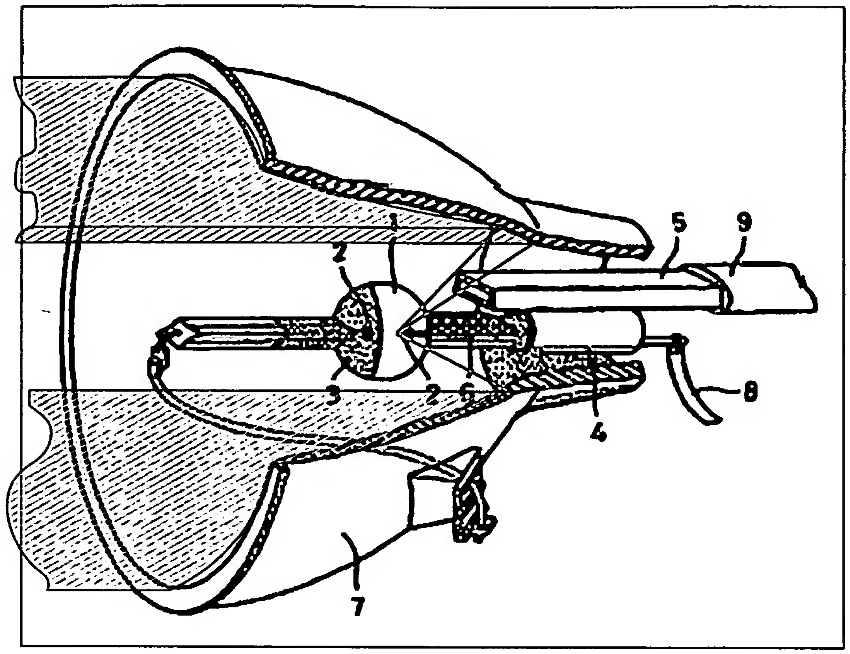
FIG. B



For typical UHP-lamps, Sakugi-like cooling is shown Fig. C. Discharge vessel and reflector dimensions are the same as in Fig. A. The left portion of the figure shows a crosscut of the reflector from the side, the right portion of the figure shows a front view of the lamp. The nozzle size and distance (blue area in the figure) was chosen following figure 1 of Sakugi. The yellow area is the usable beam path, whereas the orange area is the beam path that is lost due to the nozzle arrangement.

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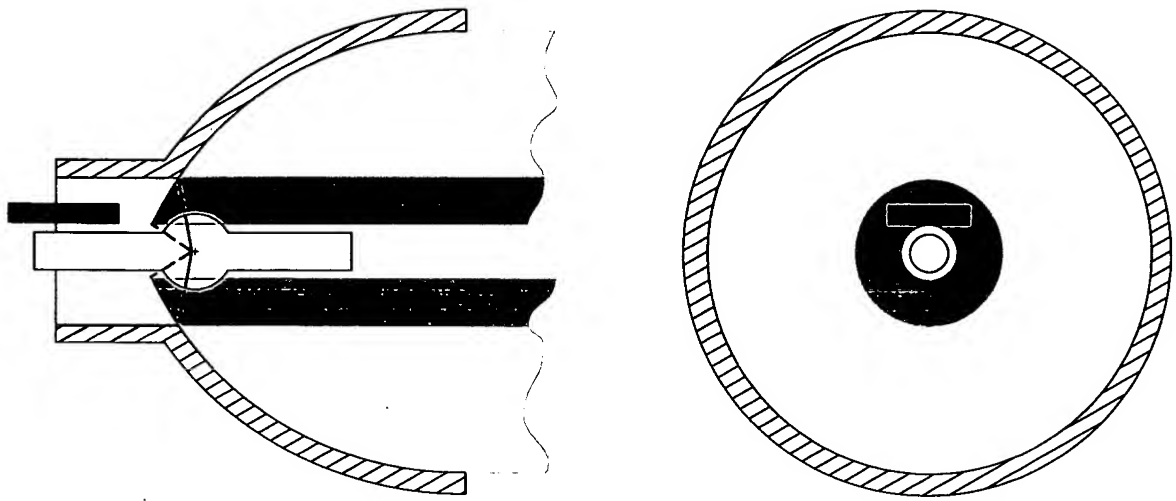
FIG. C

Sakugi



It can be seen that the size and shape of the nozzle requires a substantially large bore in the reflector neck —also shown in figure 1 of Sakugi. The unused space around the nozzle is necessary in order not to bring the nozzle into close contact with the glass/ceramic of the reflector and the discharge vessel, which could otherwise result in cracking of the reflector or discharge vessel due to different thermal expansion of the nozzle and the other lamp parts. This unused space can also be seen in Sakugi's figure 1. Usually, the bore in the reflector neck is made symmetrically, to facilitate reflector and lamp production. Therefore, a large portion of the emitted light will be lost in such an arrangement. This light loss is inevitable, since according to Sakugi, the nozzle is arranged on the seal section of the discharge vessel, opposite to the opening of the reflector.

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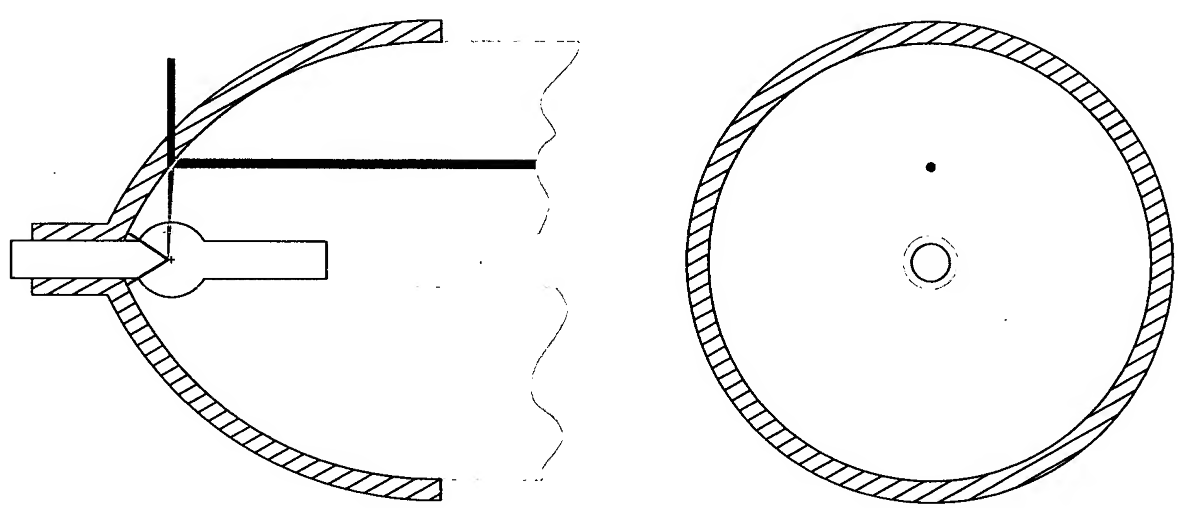
Contrary to this, Fig. D shows a nozzle arrangement according to the preferred embodiment of the claimed invention. Since the nozzle is not located in the neck of the reflector, the bore of the reflector does not have to be increased and the reflecting coating of the reflector can be extended up to the discharge lamp.

FIG. D

Philips



The much smaller nozzle can easily be fitted into a small hole in the reflector. The small hole in the reflector substantially reduces the blocked beam path. Essentially, almost all the light emitted by the discharge can be reflected towards the application. This arrangement is clearly different from Sakugi's, since it uses different nozzle sizes, locations, and mounting technologies.

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The quantitative effect of the different nozzle arrangements on the beam path can be estimated by comparing the area of the blocked beam path to the total beam path. In a different approach, the solid angles of the blocked and total beam path can be used. This method also takes into account that different areas of the reflector have different distances to the discharge (closer areas will receive higher intensities). The results of these two calculations can be seen in the following table.

	Area blocked	Solid angle blocked
Sakugi	9.9 %	40 %
Present Invention	0.04 %	0.04 %

The difference between the two cooling-methods is substantial. The solid angle blocked shows that with the Sakugi-nozzle, large amounts of light will be lost. This loss has to be compared to the gain to be expected when the lamp is operated at higher power (usually, better cooling enables operation at higher powers). Typical power-improvement steps for UHP-lamps are between 10 and 20 %. Thus, with a cooling as described by Sakugi, the gain due to higher power will be substantially lower that with a cooling as disclosed by us.

Applicants accordingly respectfully submit that the Examiner has not made a *prima facie* case against claim 1.

CLAIM 3

Claim 3 recites turbulent flow.

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Applicants do not find that Sakugi teaches or suggests a turbulent flow for cooling the lamp -- at least not so far as Applicants can discern in the translation in their possession. "Turbulent flow" is a scientific/technical term referring to the flow of a (liquid or gaseous) fluid that is not laminar or layered, but shows such effects as backflow and vortices. Turbulent flow develops when the different layers of a fluid start to interact with each other (e.g., exchanging momentum) and thus get intertwined with each other. Typically, turbulence forms for high velocities, low viscosities, and small tube diameters. Turbulence is not equivalent to high-speed flow.

Sakugi discloses a "blast-nozzle", but this description does not imply per se that the flow from this nozzle is turbulent. It still depends on the actual velocity of the blast and configuration of the entire lamp whether turbulence will develop. "Turbulent flow" is a scientific/technical term that is not the opposite of the terms "stagnant or calm", but the opposite of the scientific/technical term "laminar". It is not sufficient for a flow to have high velocity to develop turbulence. A laminar flow can also be of high velocity, but the different layers of the flow do not mix/intertwine. Therefore, the heat transfer coefficient of a laminar flow is substantially lower than that of a turbulent flow. On the other hand, laminar flows are often used when better control of the flow pattern and/or lower noise level is desired.

The term "blast nozzle" not only does not imply that a flow is turbulent; the term also does not even specify a certain velocity of the cooling airflow. Moreover, it is not clear that the term "blast" as used in the Sakugi translation means what the Examiner thinks it means. The term "blast" in English implies a violence that would be ill placed inside something so delicate as a lamp. It could be a translation error.

Furthermore, the shape of the nozzle disclosed by Sakugi (large cross section) usually is used to create laminar flows. The smaller the cross section of the nozzle, the more air layers will move close to the nozzle-walls. When the air enters the region outside of the nozzle, the sudden change of environment (e.g., the pressure change) often leads to breaking away of the laminar, layered airflow, thus leading to turbulence. Contrary to this, in the patent of Sakugi the nozzle has a large cross section, so that a significant portion of the air will not suffer from the direct interaction with the nozzle-wall, thus helping in extending the laminar flow.

In contrast, Applicants disclose a cooling system that is designed in so that turbulence around the discharge vessel will occur. Such turbulence is desirable, since the heat transfer coefficient of a cooling fluid is substantially increased when the fluid flows in a turbulent manner.

Applicants according respectfully submit that the Examiner has failed to make a *prima facie* case against claim 3.

Claim 4

This claim recites two nozzles at an angle.

The Examiner states, without citing a reference, that it is known to use more than one nozzle. Since the Examiner does not indicate which reference is allegedly being applied in combination with Sakugi here, it is difficult to determine whether the combination would be feasible.

Sakugi's cooling arrangement is also not similar to that disclosed in the present application. . In Sakugi's disclosure, a single nozzle mounted in the neck of the reflector is used

to cool the upper part of the discharge vessel. In this arrangement, a second nozzle cannot be placed without interfering with the intention of the disclosed device. The nozzle cannot be mounted in the lower part of the reflector neck, since it would cool the lower part of the discharge vessel as well. Such a cooling is not intended by Sakugi (paragraph 11, "lower temperature is almost changeless").

Moreover, even assuming *arguendo* that there were a second nozzle, similar to the first nozzle, the hypothetical nozzle – similarly placed in the neck of the reflector – would not be at an angle to the first nozzle, and therefore not create any turbulence in the flow pattern.

It is difficult to see where else a hypothetical nozzle might be placed, given the very large size of Sakugi's nozzle. Any other location would unacceptably compromise operation and light output of the lamp.

Furthermore, it has to be stated again that a turbulent flow is by no means the same as "more cooling" (page 5 of examiner's statement). A turbulent flow changes the quality, not necessarily the quantity of a fluid flow. Close to the transition from laminar to turbulent flow, e.g., the flow volume will be the same, while many properties of the fluid will change (e.g., transport properties like the heat transfer coefficient). Therefore, creating a turbulent flow is not the same as using more nozzles to increase the volume flow. It is a much more efficient way of removing heat from the discharge vessel.

Applicants accordingly respectfully submit that the Examiner has not made a *prima facie* case against claim 4.

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Claim 5

This claim recites at least two nozzles, which are at 90 degrees to one another. The Examiner purports to find this in Sakugi. Applicants do not understand this at all. The Examiner has previously admitted that Sakugi does not teach multiple nozzles. *A fortiori*, Sakugi cannot teach or suggest an arrangement an angle of 90 degrees between nozzles. Applicants accordingly respectfully submit that the Examiner has not made a *prima facie* case against claim 5.

Claim 7

Claim 7 recites that one nozzle is directed at a region of the discharge vessel that is at a top position and a second nozzle is directed at a region of the discharge vessel that is at the bottom. As explained in the specification, this recitation has the functional advantage of being able to cool the top, which is hotter, more than the bottom, which is cooler – particularly when the orientation of the lamp is changed.

The Examiner admits that the claimed configuration is not shown in Sakugi, but asserts, without support in the reference, that the claimed configuration is obvious. Applicants respectfully disagree. In order for the new configuration to be obvious, the reference would have to recognize that there was a problem with the existing configuration. The Examiner has not shown where the reference recognizes any usefulness to additional nozzles, particularly since the reference does not appear to recognize a need to change orientations. Applicants accordingly respectfully submit that the Examiner has failed to make a *prima facie* case against claim 7.

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Claim 8

Claim 8 recites that velocity of flow of gas passing through at least one of the nozzles can be controlled as a function of operating position. This has the functional advantage that if the lamp is moved the hot, top region of the lamp might be in a different place inside the lamp, because heat rises. Accordingly, airflow can be adjusted to compensate for the change in position of the hot region.

The Examiner purports to find this recitation in Sakugi. Applicants are not finding this at all. As Applicants read the disclosure of the reference, the nozzle is aiming at cooling the discharge vessel only at its top, but Applicants do not find any teaching or suggestion that the lamp orientation may be changed. Applicants therefore fail to understand how Sakugi could have any teaching or suggestion of solving a problem that Sakugi apparently fails to recognize. Applicants accordingly respectfully submit that the Examiner has failed to make a *prima facie* case against claim 8.

Sakugi/Kaneko

Claims 6 and 9 stand rejected over Sakugi/Kaneko. Applicants do not see any motivation to combine these references in the references themselves. They appear to relate to distinct lamp mechanisms. Using both would merely be redundant and reduce lamp light output. Applicants accordingly respectfully submit that the combination is impermissible hindsight in light of Applicants' disclosure.

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Claim 6

Claim 6 recites a sensor for sensing velocity and/or pressure and/or flow rate of the gas.

The Examiner purports to find this in Kaneko at 25. Applicants are having some difficulty with Kaneko due to the poor translation; however, Applicants understand element 25 to be a drive circuit for the lamp, per paragraph 0020, not any kind of sensor.

The Examiner refers to paragraph 7 of the Kaneko document as relating to "determining vapor pressure." Given the abysmal translation, it is very difficult to understand what Kaneko is talking about. However, it is noted that the verb "to determine" has more than one meaning. It can mean something like "to measure," but it also can mean something like "to control" or "to predestine." It appears that this latter meaning is intended. This interpretation is strengthened by paragraph 14, which states "by keeping constant the temperature which influences determining vapor pressure greatly." In other words, the document seems to be advocating "determining vapor pressure," in other words "controlling vapor pressure," by controlling temperature. Similarly in paragraphs 23 & 25, the term "determining vapor pressure" is again used without any indication of a sensor. These paragraphs seem merely to indicate what factors contribute to vapor pressure.

Accordingly, when looking at the document as a whole, Applicants understand the phrase "determining vapor pressure" as used by this translator to mean something more like "controlling vapor pressure." In any case, Applicants find no teaching or suggestion of any kind of sensor of pressure, and certainly not of any sensor of pressure of gas in a cooling nozzle. Item 25 of figure 5 is the lamp driving circuit (as explained in the text), item 19 is the external lead wire connecting the discharge vessel to the driving circuit. Kaneko employed a radiation thermometer

(item 15 in figure 2) and an amplitude-measurement device (item 13 in figure 2; probably some electrical measurement equipment to detect the lamp voltage for figure 3). These sensors measured properties of the lamp (namely temperature and lamp voltage), but no property of the cooling air. Therefore, the Examiner's statement that Kaneko describes prior art with respect to the sensors is not understood.

Claim 9

Claim 9 recites a second sensor for sensing operating position of the discharge lamp and to control velocity of flow of gas as a function of operating position.

The Examiner cites Kaneko for this proposition. Again, Applicants are not finding what the Examiner purports to find. Applicants understand, as stated above, item 25 in Kaneko's figure 5 to be the lamp driving circuit — not a sensor that detects the orientation of the lamp. Applicants understand item 24 to provide an operation signal, which detects the operation status of the lamp, i.e. whether the lamp is on or off. Therefore, Applicants do not understand the Examiner's statement that Kaneko describes prior art with respect to sensing lamp orientation.

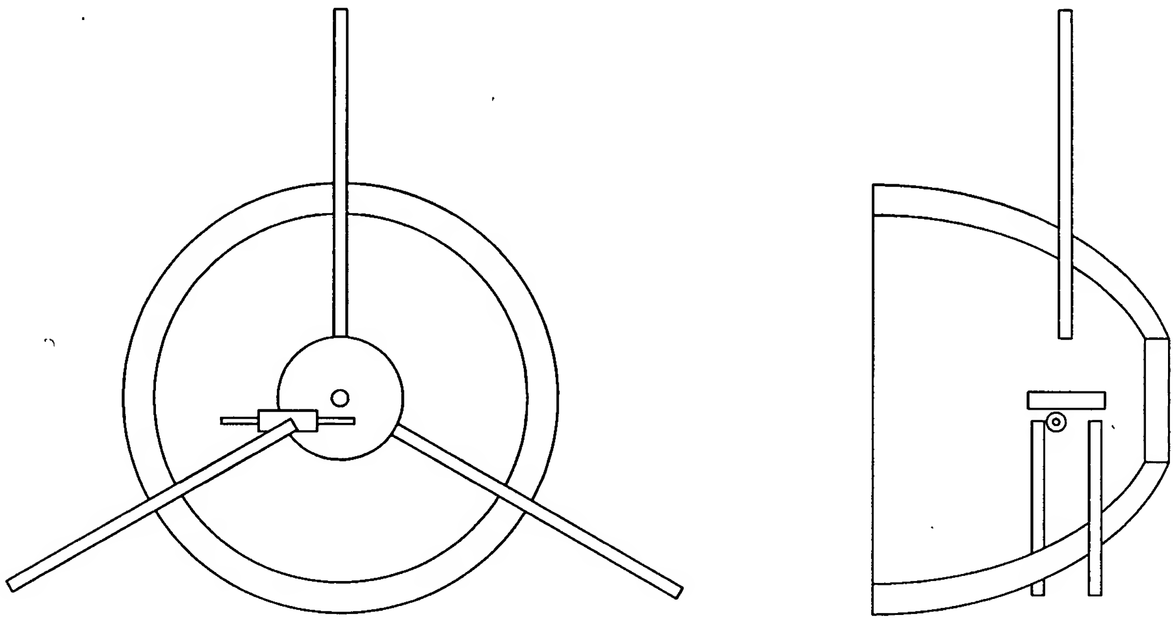
Claim 10

The Examiner asserts that Lapatovich shows cooling nozzles at the exterior of the reflector, per claim 10. In a telephone conversation dated on or about December 28, the Examiner indicated that she believes that Lapatovich's fig. 3 shows the back or bottom of a lamp reflector with nozzles at the exterior. Applicants respectfully disagree.

REMARKS

Lapatovich's figure 3 is not clearly labeled. The drawing elements are not clear – nor does the text elucidate them well. Fig. E shows a possible interpretation of the different concentric rings, by illustrating a proposed side section of Lapatovich's lamp on the right side of the figure.

FIG. E



While this figure is only one possible arrangement (others may include, for example, nozzles tilted relative to the reflector axis), this interpretation is consistent with Lapatovich's text, prior art and common usage of discharge lamps as disclosed in Lapatovich's patent, and the typical meaning of the graphical elements in the figure (namely the concentric circles). Still, the meaning of the strange shape at the upper end of the lower-left nozzle remains unclear. Normally, it could resemble a ceramic discharge lamp; but then its position within the figure does not make sense.

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In any case, as Fig. E shows, Lapatovich's figure 3 does not disclose a cooling arrangement as that claimed by Applicants in claim 10. Lapatovich's nozzles are not necessarily mounted outside of the reflector. He only describes nozzles at the lateral circumference of the lamp. This statement is not clear, since it can also mean that the nozzles touch the discharge vessel or the reflector from inside.

Applicants accordingly respectfully submit that the Examiner has failed to make a *prima facie* case against claim 10.

<u>Claim 11</u>

Claim 11 recites that the nozzles point toward the discharge element and that a turbulent flow is created around the discharge element. The Examiner purports to find this in Lapatovich. Applicants are not finding this. Per the interpretation of Fig. E above, the nozzle arrangement of Lapatovich's figure 3 does not imply the development of a turbulent airflow. In a nozzle arrangement as the one shown, a laminar flow may develop as well (depending on a large number of unknown parameters, like air velocity and nozzle and lamp dimensions). Applicants accordingly respectfully submit that Lapatovich fails to teach or suggest claim 11.

<u>Claim 14</u>

This claim recites a nozzle arranged near an exit window and pointing back approximately toward a neck of the reflector. In the preferred embodiment, this is illustrated at reference numeral 3 of Fig. 1.

REMARKS

The Examiner purports to find the recitations of this claim in Lapatovich. Applicants are again not finding this. Applicants see nozzles in Lapatovich that point perpendicular to the beam path. The Examiner even appears to concede this in rejecting claim 12.

New claim 16

In Applicants' preferred embodiment, the nozzles are pointing towards a particular position of the discharge vessel in order to create an inhomogeneous cooling pattern (cooling the hot top, more than the colder bottom of the discharge vessel). Multiple nozzles are independently operable to maintain the inhomogeneous cooling pattern. New claim 16 has been added addressing this concern.

Because the claimed invention includes independent control, it is possible – for example – to operate one nozzle when that is sufficient, or more than one when no single nozzle is sufficient (e.g., since no single nozzle is directly perpendicular above the current top of the discharge vessel). Such changes during operation can ensure effective cooling of the current top of the discharge vessel — independent of position. Less cooling medium need be blown towards the position currently at the bottom of the discharge vessel.

The art fails to teach or suggest these recitations.

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REMARKS

Applicants respectfully submit that they have addressed each issue raised by the Examiner — except for any that were skipped as moot. Withdrawal of the improvidently issued final office action and entry of the amendment is accordingly respectfully requested.

CERTIFICATE OF MAILING

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On 1/22/07 (date)
By /Barschall/ (signature)

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